MANUFACTURING APPARATUS FOR THE PRODUCTION OF MAGNETIZED WATER AND ITS METHOD

TECHNICAL FIELD

The present invention relates to a device and a method for production of magnetized water and, in particular, to a device and a method for its production by making use of the phenomenon that molecules of water form clusters and concentrate themselves in a field of pulsating magnetism.

BACKGROUND ART

Magnetized water is by nature the more significant for showing the characteristics of a peculiar water through change of the arrangement of its molecules under the influence of magnetism than the fact that its molecules gain a magnetic trait by magnetization, and thereupon various studies and researches have so far been made about the physicochemical characteristics of magnetized water.

For example, it has been reported that when water is magnetized and used in the industries the scale caused by water inside pipes decreases and that if magnetized water is used in rinsing mouths fewer dental calculi result. For another example of biological reactions in living bodies there has been a report that in magnetized water the activity of glutamate decarboxylase is greater by some 30% than in ordinary water, and so have there been many other reports on the virtues of magnetized water.

In especial, many researches have been made of uses of molecules of water in living bodies, and it is known that, in most processes of metabolism in a living body, such biochemical reactions as syntheses and degradation of protein or nucleic acid as well as storage and release of energy take place through the reactions of molecules of water in the processes of their rearrangement. However, it is also known that such biochemical reactions of molecules of water do not take place by molecules of water in direct reaction with other biological substances but some suitable solutes, which have functions as buffer, are necessary for them to take place. Water, a main solvent in a

living body, has such solutes dissolved in it as Na^+, Ka^+, Ca^{++}, Mg^{++}, Zn^{++}, Fe^-, $SO4^-$, $PO4^-$, Cl^-, etc., playing the role of a buffer by keeping the solvent's pH or osmotic pressure to a certain level.

What needs to notice here is that the above-listed solutes are capable of reacting with molecules of water and change their arrangement.

To explain in further detail, a sodium ion Na^+ and a potassium ion Ka^+ bring about in a living body quite opposite biochemical reactions. On the one hand, the former, Na^+, by a reaction with molecules of water, assumes an arrangement, whereby it is encircled by these molecules, resulting in dispersion of them to assemble around itself, causing this way a swelling of the arrangement of molecules of water. Whereupon, water's osmotic pressure increases, and this way, too, weakening the dipolarity of water by forcefully attracting molecules of water, to be followed by decrease of water's reaction with other solutes.

On the other hand, the latter, potassium ion, Ka^+, assumes an arrangement in the form of encircling molecules of water, and thus, by gathering them close together group by group, forms clusters of molecules of water.

Lately, according to the results of the studies through NMR (nuclear magnetic resonance) of the clusters of molecules of water existing on the inner walls of endoplasmic reticulum or mitochondria in living cells, it has been learned that, compared with the constituents of the substrate of a cell, the clusters of molecules of water are in greater concentration, and this can be explained by stating that potassium ions Ka^+ concentrate the clusters of molecules of water and facilitate the reaction of the resultant concentrated molecules of water with structures of endoplasmic reticulum or mitochondria within cells. Accordingly, it can also be said that a smooth intercellular metabolism takes place through the phenomena of concentration of the clusters of molecules of water.

DISCLOSURE OF THE INVENTION

In the present invention, accordingly, it is intended to provide a device and a method therewith for production of magnetized water good for the metabolism in a living body by changing the arrangement of molecules of water by a pulsating magnetic field, without the help of any inorganic substances, but through formation thereby of the clusters of molecules of water, their concentration, and maintenance of their magnetic properties for a certain length of time.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a drawing to illustrate the device for production of magnetized water in Embodiment Example 1 of the present invention.

Fig. 2 is a waveform diagram of the voltage on a first coil in Embodiment Example 1.

Fig. 3 is a waveform diagram of the voltage induced on a second coil in Embodiment Example 1.

Fig. 4 is a drawing to illustrate the device for production of magnetized water in Embodiment Example 2.

Fig. 5 is a drawing to illustrate the device for production of magnetized water in Embodiment Example 3.

Figs. 6 and 7 are the drawings for explanation of the magnetic relaxation time in the present invention.

Fig. 8 is a drawing for explanation of the time spent on magnetization in the present invention.

Figs. 9a through 9f show the changes in the viscosity of water I the present

invention.

Figs. 10a and 10b show the conductivity rates of the magnetized water in the present invention.

Figs. 11a and 11b show the solubility of the magnetized water in the present invention.

Fig. 12 is a table to explain the oxygen solubility of the magnetized water in the present invention.

Fig. 13 is a table to explain the free radical activity of the magnetized water in the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

To attain the above-said objective, the device for production of magnetized water of the present invention is characterized in that it comprises a chamber, which houses a vessel containing purified water in it, and the outer wall of which is wound with a coils of wire by a certain number of rounds; a means of supplying power, which converts alternating current into a series of pulsating direct current signals with a preset frequency to impress said coils in order to generate a pulsating magnetic field inside said chamber; a means of cooling placed outside said chamber to cool the heat caused by said coils; a means of sensing temperature to detect changes of the temperature caused by said coils; a means of measuring time to measure the time of magnetization of said purified water; and a means of control, which compares the time spent on the actual magnetization with the preset time for it and has said power supply means break off the impression of said pulsating DC signals directly the preset time is reached.

The device is also characterized in that, besides the above-listed basic constituents, it further comprises a water tank which, placed outside said chamber but connected with it, which receives the supply of water from an outside source; and that the water in said tank is magnetized in said chamber and thereafter the magnetized water is

circulated to said tank, said tank having a means of outlet, too, to discharge the magnetized water outside with ease.

The method for production of magnetized water in the present invention is characterized in that a magnetism having a certain intensity and pulsating with a preset frequency is impressed on the water purified and contained in a tightly closed vessel, the impression with said magnetism is continued so long as the spin arrangement of the molecules of water keeps unchanged, and this way the molecules of water are made to form clusters, whereby enriched magnetized water is obtained.

Below, the invention is described in further detail, the attached drawings being referred to each time.

Fig. 1 being a drawing for description of the device for production of magnetized water in Embodiment Example 1 of the present invention, said device is constructed, as is shown in the drawing, of a chamber 4, which houses a vessel to contain purified water inside and which is wound with coils of wire by a certain number of rounds; a power supply section 6, which converts the alternating current (AC) of electricity into pulsating direct current (DC) signals for impression on said coils in order to induce a magnetic field to the inside of said chamber 4; a cooling section 8, placed outside said chamber 4 to cool the heat caused by said coils; a temperature sensing section 10 to detect changes of the temperature caused by said coils; a time measuring section 12 to measure the time spent on magnetization of the purified water; and a control section 14 to control said power supply section 6 in accordance with the temperature detected by said temperature sensing section 10 and the time of magnetization measured by said time measuring section 12.

It is preferable to place a counter-electromotive force cutoff circuit 16 between said coils and power supply section 6, whereby to block intrusion of counter-electromotive force which is given rise to by said coils and shield said power supply section 6 from it.

Of coils, in order to minimize the magnetic field offset effects which are to be occasioned at the central part of said coils by the influence of the polarity a second coil 2 is connected in series, at an interval P, with a first coil 1, which receives said pulsating DC signals from said power supply section 6.

The first coil 1 and said second coil 2 are enwrapped with a shielding screen to block off the counter-electromotive force which is given rise to when the pulsating magnetic filed is induced.

The chamber 4 will be of a vertical structure large enough to house a vessel of the size of 1-liter PET bottle, and it will be formed of nonferrous metals to be capable of inducing magnetism of a proper intensity.

The power supply section 6 is so constructed as to convert the alternating current into a direct current of 16~24V for supply for the peripheral devices, e. g., said cooling section 8, generate a sufficient pulsating magnetic field in a short time, and convert said alternating current into DC signals pulsating at 3~7 Hz per second to input them to said first coil 1 lest the counter-electromotive force which is generated inside the coils should offset said generated magnetic field, while it is preferable to provide both the inputting and outputting terminals with a double fuse device for the sake of an operator's safety.

The cooling section 8 is placed outside said chamber 4, comprising an air-cooling pan and a circulatory air-passage (not shown in the drawings).

The operation of the device in Embodiment Example 1, constructed as above, is described below.

After a tightly closed vessel containing purified or twice-filtered water is placed in said chamber 4, power is turned on, and a power supply section 6 converts the alternating current AC supplied under the control of said control section 14 into DC

signals pulsating at 3~7Hz per second to input them to said first coil 1.

When said pulsating DC signals are impressed on said first Coil 1, a magnetic field with an intensity to satisfy the range of 600~1,000 gauss and pulsation in the range of 3~7Hz is generated inside said chamber 4 by virtue of the intermission of said pulsating DC signals. At this time the waveform of the voltage of the pulsating DC signals impressed on said first coil 1 is as shown in Fig. 2, that on a second coil 2 being as shown in Fig. 3.

When such a pulsating magnetic field as induced the way described above is generated in repetition for a given length of time, the arrangement of the molecules of the purified water contained in said vessel inside said chamber 4 sharply changes as time passes, but at a certain time this change slows down and reaches the stage of saturation. At this time the molecules of water form clusters and a phenomenon of condensation occurs. Now the time for the arrangement of the molecules of water to reach saturation is termed the magnetization time.

Such a phenomenon is distinct in that the spin arrangement of hydrogen atoms persists, from the phenomenon of magnetic resonance, in which the hydrogen atoms undergo a spin arrangement under strong magnetism for an instant but immediately to return to their original state. In this case the hydrogen atoms exert an influence on the hydrogen ions peculiar to the dipolarity of the molecules of water and thereby the distances between the hydrogen atoms gradually decrease. This can be seen from the analysis of the NMR (nuclear magnetic resonance) by the fact that the magnetic relaxation time, i.e., the time for the molecules of water to return to their original state by their rearrangement, increases. In the air, the molecular arrangement of magnetized water returns almost to its original state in about 24 hours.

The magnetization time in the present invention, it has been learned through experiments, is preferably to be set at 6~24 hours.

The magnetization time is set at said control section 14 in advance and said control section 14 observes to see whether the time measured at said time measuring section 12 is past the preset time for magnetization.

If, as a result of this observation the measured time is over the preset time, said control section 14 controls said first coil 1 to stop impression of said DC pulsating signals on said first coil 1.

When magnetization of water is performed by impression of pulsating DC signals on said coils this way, heat is generated in said first and second coils 1, 2 which raises the temperature inside said chamber 4, and if the temperature inside said chamber 4 goes beyond a certain degree, e.g., 30°C, said temperature sensing section 10 sends off a warning signal.

In response to said signals from said temperature sensing section 10 said control section 14 so controls said power supply section 6 that the latter will impress a driving signal to said cooling section 8. This way the temperature inside said chamber 4 is maintained consistently at a desired level.

Next, Fig. 4 is an illustration to describe the device for production of magnetized water according to Embodiment Example 2 of the present invention, and the device is in the basic idea the same as that of Embodiment Example 1.

The device in this example is the same as Example 1 in that it comprises a chamber which houses a vessel containing purified water and which is wound with coils on its outside by a certain number of rounds; a shielding screen to cover said coils; a power supply section which converts the originally alternating current of electricity into pulsating DC signals and impresses them on said coils to induce a magnetic field to the inside of said chamber; a temperature sensing section to detect the changes of temperature caused by said coils; a time measuring section to measure the magnetization time of said purified water; and a control section, which so controls said

power supply section to impress pulsating DC signals on said coils according to the temperature sensed by said temperature sensing section and the time measured by said time measuring section. Accordingly, superfluous repetitive detailed descriptions are omitted, while as to the same constituents the same numbers or symbols are used for the sake of convenience.

The main characteristics of the device in this example lie in that a way of cooling by compression of refrigerant by evaporation is adopted, instead of the air-cooling method in Example 1. That is, a cooling pipe 20 serving as a vaporizer is set in the form of a screw between said chamber 4 and a coil 3, and this cooling pipe 20 is connected by a connection pipe 28 with a compressor 22 and a condenser 24, whereby the refrigerant issuing from said cooling pipe 20 can be resupplied to said cooling pipe 28 through said compressor 22 and said condenser 24 to augment the cooling, resulting in a more efficient cooling than otherwise of the heat of coils and maintain the temperature of the magnetized water in the vessel in said chamber 4 at its proper level (4°C ~8 °C).

In order further to improve the cooling efficiency, a cooling pan 26', 26" is placed on the outside respectively of said coil 3 wound round said chamber 4 and said condenser 24 in an ordinary way, whereby, in addition to said cooling by compression by vaporization of said refrigerant, a secondary cooling can be performed by these cooling pans. In this example it is not necessary to divide said coil 3 in two, as was dine in Example 1, because the cooling is thus much more efficient in this example.

Further, to house all these additional constituents, a case 30 is formed, which has a partitioning board 36 inside it, the spaces above and below said partitioning board 36 are respectively made into a magnetizing chamber 32 and a cooling chamber 34. Here in said magnetizing chamber 32 a chamber 4 wound with said coil 3 and said cooling 20 pipe as well as said cooling pan 26' are placed, while in said cooling chamber said compressor 22, said condenser 24, and said cooling pan 26" are placed on the floor.

The upper part of said case 30, that is, said magnetizing chamber 32, is cut out to provide an opening as large as the diameter of said chamber 4, just enough to bring in and out said vessel of water, while said opening has to have a lid capable of opening or closing at will for the purpose of protection of the magnetizing space and of prevention of accidents which might possibly be caused by inadvertency of an operator at work.

The partitioning board 36 preferably has a number of holes for exhaust of heat and drainage of water, and said magnetizing chamber 32 and said cooling chamber 34 have to be of a structure good for smooth circulation of air.

For efficient operation and its easy observation said control section 14 is placed at a proper position in the front or a side of said case 30, and said control section 14 (See Fig. 1) is of an ordinary structure of a panel (not shown in the drawings).

On the bottom of said case 30 three or more castors are fitted for its easy movement about.

The operation of the device in Embodiment Example 2 of the present invention is basically the same as that of the device in Example 1, except that said coil for impression of the pulsating DC signals from said power supply section 6 (See Fig. 1) is single and not plural in number, wherefore its detailed description is omitted here.

Fig. 5 is for illustration of Embodiment Example 3 of the present invention, in which the device for production of magnetized water according to Embodiment Example 2 above is in use in the home or offices; where, the basic idea of production of magnetized water is the same as that in the cases of the devices in Examples 1 and 2. The same numbers and symbols as used in these earlier examples are therefore in use in the descriptions of this example also.

The device in this example is characterized, however, by a specific construction, in which it has inside said magnetizing chamber 32 a water tank 18, separate from said

chamber 4 for production of magnetized water, whereby the water in said tank 18 is magnetized in said chamber 4, restored in said tank 18, and made available outside through an ordinary faucet 38.

Below, the device in Embodiment Example 3 is described in further detail.

In the upper part of said case 30, which is divided into said magnetizing chamber 32 above and said cooling chamber 34 below, viz., in the upper part of said magnetizing chamber 32 is placed a water tank 18, for storage of water, which is connected with said chamber 4 by a connection pipe 28' joined to its upper and lower parts. On said connection pipe 28', which connects said chamber 4 and said water tank 18, is placed a circulatory pump 40, which is not merely for drawing the water from said water tank 18 but also for sending it back after magnetization for storage in said water tank 18. If not shown in Fig. 5, it is so structured that said water tank 18 is automatically supplied with water from an outside source, and that this supply will have to be mechanically controlled through a constant measurement of the water in said tank 18 in order that it may always keep a certain quantity of water or magnetized water stored in it.

At one side on the bottom of said water tank 18, a drain pipe 28" is connected for discharge of the magnetized water through said faucet 38, and said drain pipe 28 has a cooling pipe 20 attached to it for cooling the water being drained.

On said chamber 4 in this example, too, a coil and shielding screen are set, as were in Example 2 above, while a power supply section, a control section, a time measuring section, a temperature sensing section, a counter-electromotive force cut-off circuit, etc. are also placed, whose construction and operation are omitted from description here as they are the same as in Embodiment Examples 1 and 2.

Meanwhile, though Fig. 5 shows the arrangement of a compressor, a condenser, a cooling pan, etc., inside said cooling chamber 34 formed in the lower part of said case 30, as in Embodiment Example 2, it is also preferable to have a cooling pan inside the

aforesaid magnetizing chamber, too.

Moreover, it is preferable in this example also to have castors (not shown in the drawings) under said case 30 for a smooth movement of this particular item of equipment, while said control section, preferably structured in a panel, can be attached to the front or on a side of said case 30 to secure a handy operation of the device and its quick observation.

Now the operation of the device in Embodiment Example 3 is basically the same as that of the device in Examples 1 and 2.

Only, in this example, said water tank 18 is provided separately from said chamber 4 to receive supply of water from an outside source and also restore the water after its magnetization in said chamber 4. Here, said circulatory pump which circulates the magnetized water is controlled by said control section 14 (See Fig. 1) in reference to the magnetization time, the quantity of used water, and other conditions. In the case where much water is in use, the magnetization time is shortened and the operation cycle of said circulatory pump is lessened, to keep said water tank always full of magnetized water.

Therefore, according to the device for production of magnetized water in this example it is made possible for all times for people readily to drink magnetized water through said faucet 38, as it is in the case of the water purifier to serve both cold and hot drinking water in the home or offices.

The physicochemical properties of the magnetized water produced by the device of the present invention are described below on the bases of its experiments. The magnetized water used in the experiments was the water produced of deionized distilled water sealed in an airtight glass bottle inside said chamber (in Embodiment Examples 1 and 2 of the present invention).

First, to speak of the magnetic relaxation time, a phenomenon of its increase was observed through NMR analysis, when irradiation with a magnetism pulsating at 7Hz and with an intensity of 600~1,000 gauss continued for 24 hours, while the temperature of said chamber 4 was kept at 30°C.

As seen in Fig. 6, the magnetic relaxation time showed a sharp increase for the first five hours and a mild rise after eight hours to reach its highest at the 12th hour since the irradiation had started, but thereafter the rise became sluggish and continued so until the 24^{th} hour. The thus increasing magnetic relaxation began decrease finally to stop exponentially and functionally, as shown in Fig. 7, as the irradiation was discontinued. The decrease was sudden and sharp for the first five hours after discontinuation of the irradiation, and continued its sluggish decrease for the hours until the 24^{th}.

In Figs. 6 and 7, the vertical and lateral axes respectively show the time required for magnetization of deionized distilled water and the time T corresponding with the time for the changes of the gaps between the hydrogen atom pairs in the molecules of deionized water. Here, the time T serves as indices to the magnetic relaxation times.

Meanwhile, as shown in Fig. 8, the magnetic relaxation time for the magnetized deionized distilled water was greatly increased to 2,453.3 ± 3.21 from the 2,261.7 ± 4.56 for ordinary deionized distilled water, while it increased just a little bit to 2,243 ± 1.31 when the magnetized deionized distilled water had 1.0% potassium chloride (KCl) dissolved in it by contrast with the 2,118 ± 7.61 for ordinary deionized distilled water with 0.5% sodium chloride (NaCl) dissolved in it.

As for viscosity of the magnetized water, the deionized distilled water magnetized for 24 hours showed, as in Fig. 9a, a very rapid increase in viscosity in the initial period of time, compared with ordinary deionized distilled water, but the thus quickly increased viscosity got decreased to the level of the latter at about the 12^{th} hour.

A change of viscosity like this in water became distinct when sodium chloride (NaCl) and potassium chloride (KCl) were each added to the water, as shown in Figs. 9b through 9f.

As seen in Figs. 9b through 9f, ordinary deionized distilled water first showed a decrease in viscosity as the added sodium chloride (NaCl) was increased by 0.1M, 0.2M, but later came to normal, while, in the case of the magnetized deionized distilled water, it showed a decrease in viscosity in the earlier stage when the sodium chloride (NaCl) was added by 0.1M only but showed almost no phenomenon of its decrease in the initial period when the sodium chloride (NaCl) was added by 0.2M and 0.4M.

Yet, as shown in Figs. 9d through 9f, a phenomenon of initial increase in viscosity was prominent when, to the magnetized deionized distilled water, potassium chloride (KCl) was added by 0.1M, 0.2M, and 0.4M, and this increase in viscosity was especially prominent when the addition was by 0.1M to continue until about 2,000 minutes, after which, characteristically, it started quickly to return to the level of ordinary deionized distilled water; when potassium chloride (KCl) was added by 0.2M in dissolution the initial increase in viscosity persisted until 4,000 minutes, and when the addition was raised to 0.4M the initial increase persisted until 6,000 minutes.

As for conductivity, it was seen that in the cases of both the magnetized water and ordinary deionized distilled water conductivity considerably decreased, while in the cases of the water purified of ordinary fresh water and the tap water the decrease in conductivity was less. When sodium chloride and potassium chloride were added by 0.01% in dissolution, however, the conductivity instantly increased, as shown in Figs. 10a and 10b, and the duration of the increased conductivity was slightly the more in the case of potassium chloride added than of sodium chloride. This phenomenon is interpreted to mean that, in the case of ordinary water, NaCl or KCl is ionized and quickly rearranged along with the molecules of water, while in the case of magnetized water sodium ion (Na^+) or potassium ion (K^+) instantly separates to deter the rise of conductivity, because the molecules of water are in close arrangement by virtue of its

strong hydrogen bonding.

Next, as to the maximum solubility speed, when that of each NaCl and KCl in water was measured by the use of Sephadex G-50 column in order to see the reaction speed of the solvent and solute, the maximum solution speed of NaCl was, as shown in Fig. 11a, remarkably decreased in the case of the magnetized deionized distilled water than in the case of ordinary deionized distilled water, the latter being shown in a dot line; the difference in maximum solution speeds of ordinary deionized distilled water and magnetized water became smaller finally to come to almost equal as the condensation of NaCl approached its saturation. Meanwhile, the maximum solution speed of KCl increased in the magnetized deionized distilled water slightly more than in ordinary deionized distilled water, as is indicated by a dot line in Fig. 11b, but the difference disappeared as the condensation of KCl increased to approach its saturation.

Again, as to the pattern of crystal formation in gypsum, NaCl, and KCl, it was learned that the structural composition was denser and more compact when gypsum was hardened by the use of the magnetized deionized distilled water than of ordinary deionized distilled water, and the larger crystal construction was obtained the faster in the former than in the latter case. When NaCl or KCl was added by 1% and 5%, the magnetized deionized distilled water formed by far the denser, larger crystal constructions than did ordinary deionized distilled water.

Then, as to the magnetized water's oxygen solubility, as seen in Fig. 12, it decreased the more as magnetization went on in the case of the magnetized deionized distilled water than in the case of ordinary deionized distilled water. In especial, from the vessel where the magnetization took place in a tight closure quite a quantity of gaseous substance was observed escaping. When natural fresh water was magnetized, too, the hydrogen solubility decreased.

In Fig. 12, the number 1 in the lateral axis indicates the case of ordinary water, 2 of ordinary water exposed to atmosphere for six hours, 3 of ordinary water exposed for 12

hours, 4 of the deionized distilled water magnetized for six hours, and 5 of the same, magnetized for 12 hours, while the numbers in the vertical axis shows the oxygen solubility.

As to free radical activity of the magnetized water, as shown in Fig. 13, the coloring reaction by p-nitro-phenylacetate was the less in the case of the magnetized water than in the comparable ordinary deionized distilled water, and the difference became bigger as magnetization proceeded.

In Fig. 13, the number 1 in the lateral axis indicates the case of ordinary deionized distilled water, 2 of the same water magnetized for six hours, 3 of the same magnetized for three hours, 4 of tap water, and 5 of natural fresh water, while the numbers in the vertical axis indicate the optical density, OD.

Finally, as to the polymerase chain reaction (PCR) and the enzymatic reaction of restriction endonuclease by the use of the magnetized water, it was learned that the production of DNA increased in the PCR which used the magnetized water, compared with where the comparable ordinary deionized distilled water was used. When Taq (thermos aquaticus) was gradually decreased, too, the PCR products slightly increased where the magnetized water was used, compared with where the comparable ordinary deionized distilled water was used, and when template DNA was gradually decreased a phenomenal increase of PCR products was confirmed in the case of the magnetized water than in the other.

Meanwhile, in the enzymatic reaction activity of restriction endonuclease, too, it was observed greater in the case of the magnetized water than in the comparable ordinary deionized distilled water.

INDUSTRIAL APPLICABILITY

As has been described above, when the device for magnetizing water and the method therefor are applied, it is possible to rearrange the molecules of water by the use

of a pulsating magnetic field, even without the aid of other inorganic salts, and this way it is possible to facilitate formation of clusters of water molecules for its enrichment and, moreover, to maintain such characteristic properties of the magnetized water for some time (6~24 hours), which invariably helps obtainment of magnetized water, which does not merely activate provision of nutrients demanded by living bodies but stimulates their metabolism also.